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COMPU-MATH™ DECIMALS

Requires Applesoft, 48K, Disk Drive



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COMPU-MATH DECIMALS

By Sherwin A. Steffin and David G. Mullich

A total instructional package designed for use in both classroom and home environments. Decimals consists of a diagnostic Pre-Test and seven Learning Units, this system identifies the learner's existing skills and routes him to the appropriate learning experience. Ease of operation and a liberal use of screen graphics motivate young learners to work unassisted. Post-testing validates that learning has taken place.

For Apple II and II-plus computers
Requires 48K, Applesoft, and Disk Drive

DEVELOPED EXCLUSIVELY BY:

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COMPU-MATH DECIMALS

INTRODUCTION

A number of software development companies have, from time to time produced materials which were designed to provide computer users with instruction in various subject areas. Among these areas of knowledge is frequently found an effort to produce instruction in the area of arithmetic. Since there are now a number of such programs available, it seems reasonable to ask, "Why another one?"

The authors of Decimals believe there are enough significant differences in these programs to make them worthy of purchase by the parent wishing to improve his child's skills in arithmetic, or the teacher wishing to employ instructional computer programs within the classroom. These important features include:

- <1> Pre-testing of the learner to assess current skill levels before entry into the Learning Programs. This Pre-Test gives the user direct information as to the specific skills he currently holds, and then routes him to the appropriate beginning Learning Program.
- <2> Skill development is expressed in terms of specific Performance Objectives which are made explicit to the learner before instruction begins in each Learning Unit.
- <3> The following major skill areas are identified and pooled within each Learning Program. These are:

DEC.1 - Definition and Decimal Conversion

This unit introduces the learner to the concept of the decimal as being another form of the fraction. He is helped to gain skills in the conversion of fractions to decimals and the conversion of decimals to fractions. The concept of the decimal point and place holders to the right of the decimal point are introduced.

DEC.2 - Addition of Decimals

In this unit, the learner is introduced to the concept that the process of adding decimals is precisely the same as that of whole numbers. Replacement of trailing zeros to insure appropriate decimal placement and carrying of columnar values is developed.

DEC.3 - Subtraction of Decimals

Again, the concept of placement of trailing zeros is reinforced, as is the technique of borrowing in subtraction. Emphasis is placed upon the skill of subtraction as it applies either to whole numbers or to decimals.

DEC.4 - Rounding Off Decimal Numbers

Since the skill of rounding to a specified number of places is necessary to multiplication and division of decimals, this unit is now presented before the presentation of the Multiplication and Division Units. The terms "rounding to N decimal places" and "rounding to N significant digits" are both developed and reinforced with practice.

DEC.5 - Multiplication of Decimal Numbers

The emphasis in this unit is placed on identifying the correct decimal point placement after multiplication has been completed. Moreover, the learner is expected to round answers to a specified number of places.

DEC.6 - Division of Decimal Numbers

To help the learner gain skills, the algorithm for long division is reviewed and the learner is given practice in this process before going on to the division of decimals. As in the multiplication unit, heavy emphasis is placed on correct decimal point location.

DEC.7 - Percentage

Conceptually, students have great difficulty in mastering the skills associated with the determination of percentage and the determination of the value of a number when multiplied by a given percentage. Heavy instructional practice is oriented to helping the student acquire both these skills, as well as, determination of percentage increase or decrease from one value to another.

- <4> User proofing is established through a number of methods which make it impossible for the young user to "crash" the program either through lack of knowledge or the desire to do so.

THE USER SECTION

The next pages of this documentation are provided specifically for the young user, and if multiple copies of this program are purchased by the school, permission is herein granted for reproduction of those pages.

These instructional pages are developed to help the learner get the program system into the computer and presume limited reading skills, as well as an unfamiliarity with the computer system. Adult users of this program will still find these pages of value, and should read them prior to starting with the programs.

IF YOU ARE A KID
(Then this is just for you.)

Today, you are going to start learning about decimals!

That's because you have a neat, fun way to learn, and it's right here in front of you....the little disk and the Apple Computer you are going to use.

If you already know how to use the computer, then skip this section - if you do not, read on.

GETTING YOUR APPLE RUNNING:

There are two kinds of Apple Computers. Look at the name on the cover of the Apple. It will say:

APPLE II

or

APPLE II PLUS

Read the instructions for the computer you are using!

APPLE II

-
- <1> The disk drive is a little box, with a slot in the front. If you do not know, ask your teacher, or the person whose computer you are using, this question:

What slot is the disk drive in?

When you get the answer, write it here: Slot#-----

- <2> Turn on the TV set which is hooked up to the computer. When the screen is lit up, you are ready for the next step.

- <3> Look at the back of the computer. In the corner, you will find a switch to turn on the power to the computer... turn it on. A light will come on in the lower left hand corner of the keyboard. It will say: POWER. At the same time, the computer will make a little -beep- sound which means, "I am ready to work".

- <4> Now - look at the disk. The disk looks like a small phonograph record, inside of a black envelope. The envelope has some holes cut in it, through which you can see part of the disk. NEVER put your fingers on the part of the disk you can see, since this can damage the disk, and prevent your program from working!
- <5> Pick up the disk. Notice that the disk should have a notch cut in the side of the envelope. That notch should be facing to your LEFT, as you hold it in your hand. Slide the disk into the disk drive, as far as it will go. You will notice a latch. Push on it with your finger, until it is closed flat against the front of the drive.
- <6> Look at the keyboard on the computer. When you see a key marked <RESET>, tap it twice with your finger. You will hear a -beep- each time you do it, and see a little star in the lower left hand corner of your screen. If you do not see the stars, and some question marks on the screen, ask your teacher, or the person whose computer you are using, for some help.
- <7> Now, look at the slot number you just wrote down on the last page. Type that number. You will see it on the screen. Put one finger on the key marked <CTRL> and hold it down, while at the same time you type <P>. Then finally, tap the key labeled <RETURN>.
- <8> If you have done everything correctly, a little light will come on the drive, and you will hear the sound of a motor inside the drive. If this does not happen, go back and repeat the steps above. If you still have problems, then ask someone for help.
- <9> Now go to the section called: Using the Programs

APPLE II PLUS

- <1> The disk drive is a little box, with a slot in the front.
- <2> Turn on the TV set which is hooked up to the computer. When the screen is lit up, you are ready for the next step.
- <3> Now - look at the two disks. The disk looks like a small phonograph record, inside of a black envelope. The envelope has some holes cut in it, through which you can see part of the disk. NEVER put your fingers on the part of the disk you can see, since this can damage the disk and prevent your program from working!

- <4> Pick up the disk. Notice that the disk has a notch cut in the side of the envelope. That notch should be facing to your LEFT, as you hold it in your hand. Slide the disk into the disk drive, as far as it will go. You will notice a latch. Push on it with your finger, until it is closed flat against the front of the drive.
- <5> Look on the back of the computer. In the corner, you will find a switch to turn on the power to the computer... turn it on. A light will come on in the lower left hand corner of the keyboard. It will say: POWER. At the same time, the computer will make a little -beep-, meaning, "I am ready to work". When this happens, a little red light will show on the disk drive, and you will hear the sound of a motor running inside the drive.
- <6> If you have done everything correctly, a light will come on the drive, and you will hear the sound of a motor inside the drive. If this does not happen, go back and repeat the steps above. If you still have problems, then ask someone for help.
- <7> Now go to the section called: Using the Programs

USING THE PROGRAMS

As you look at the screen, you will see a MENU. This lets you make some choices about what you wish to do. The first choice on the menu will read: "<1> Take the Pre-Test". Select the number of the program you wish to use and type that number. The program you have selected will quickly appear on the TV screen.

Pre-Test

Now, you are ready to learn about Decimals. The first step is to find out what you already know...so you don't have to waste your time doing something you already can do. That is what the Pre-Test is for.

In all these programs, the computer tells you what you need to do to answer the questions. Don't be worried that you will do something wrong...you won't hurt the computer, or mess up the program.

After you get through with the Pre-Test, the computer will recommend that you start with one of the Learning Programs and will give you directions for doing this.

THE LEARNING PROGRAMS

The Pre-Test is here to tell you what you now know. The Learning Programs are here to teach you something new. To do well in these programs, you need to have some skills with arithmetic. Here are the skills you will need to do well in these programs:

You should be able to:

- <1> Add any two or three place whole numbers and get the correct answer.
- <2> Subtract any two or three place number from another two or three place number.
- <3> Multiply any two numbers together using long multiplication methods.
- <4> Correctly divide any evenly divisible whole number by another two or three digit number and be able to find the quotient and the remainder.
- <5> Explain these terms:
 - addend
 - minuend
 - subtrahend
 - multiplicand
 - multiplier
 - divisor
 - dividend
 - quotient
 - remainder
- <6> Add, subtract, multiply, divide, and find the common denominator of any two fractions.

If you have difficulty with these skills, ask your teacher, or your parents, or an older friend for some help.

Some Hints to You:

- <1> Take the programs in order. Each program depends on what you learned in an earlier program.
- <2> Don't try and go through all of the programs at once. There is a lot of new material to learn, and you will need to practice your new skills to get the most out of these programs.

HAVE FUN LEARNING!

TO THE TEACHER:

These programs represent a serious effort at providing a direct instructional adjunct to ongoing classroom instruction. As with any instructional material, it represents as a completed product, a synthesis of the authors' views of the best approach to be taken to the instructional problem at hand, given the resources available, and the expected context in which instruction is expected to occur.

This section of the documentation seeks to define the authors' model for instruction, explicate the instructional algorithms applied, suggest models for utilization, and finally, delineate potential modifications in the programs which make them more specifically tailored to individual classroom needs.

THE INSTRUCTIONAL MODEL:

Assumptions:

Several assumptions have been made about the learner population, the teacher, and the context in which the programs will be used:

1. Learners are assumed to have entry level skills listed below:
 - a. Addition of whole numbers, including the carrying of digits.
 - b. Subtraction of whole numbers, including the borrowing of digits.
 - c. Multiplication of single and multiple place numbers.
 - d. Division of single and multiple digit numbers, with and without remainders.
 - e. Addition, subtraction, multiplication, division, and reduction of fractions.
 - f. Definition of terms related to each of these skills noted above.
 - addend
 - subtrahend
 - minuend

- multiplicand
 - multiplier
 - divisor
 - dividend
 - quotient
 - remainder
 - numerator
 - denominator
 - lowest common denominator
2. Learners are assumed to have reading skills consonant with age and grade level placement in which these programs are offered.
 3. Learners are assumed to have NO previous experience with, or skills in, the operation of a micro-computer.
 4. These programs are expected to be used in a school environment in which one or two computers are available in the school. There is no expectation of the availability of a computer for each student.
 5. Persons having instructional responsibilities with respect to these programs are NOT expected to need programming skills, nor are they expected to have substantial operating expertise in the use of the computer.
 6. Most importantly, these programs are seen as a useful ADJUNCT to instruction, and not as a replacement for the direct instruction of the classroom teacher.

The Model:

Having started with these assumptions, a model was developed which hopefully will meet these definitions and serve to be developmental of new skills in students. This model contains the following ingredients:

1. Learners are pre-tested in descending order of a skill hierarchy for the skills which are expected to be terminal at the end of the Decimals series.

2. A scoring algorithm generates a recommendation to the learner, indicating the presence or absence of requisite skills, and suggests an appropriate starting point within the sequence of programs.
3. Each program begins with an introduction ("Instructions"), which is immediately followed by a statement of intended learning outcomes (objectives). This statement of objectives serves as an "advanced organizer" for the student.
4. Each program contains an instructional sequence, in which the learner interacts to each conceptual construct as it is introduced, and participates in a series of practice exercises in which correct performance is reinforced and incorrect performance is not accepted.
5. After concluding the instructional sequence, the learner is presented with ten (10) problems, randomly generated, and within the constraints of the specific skill(s) being taught.

Algorithmic Considerations:

There are a number of concerns that purchasers of this set of programs will have regarding the instructional algorithmic decisions which have been taken in the design of this series.

1. Why is color not used?

While the generation of a color display is certainly not outside the capability of the Apple computer, there were specific instructional considerations employed in the decision to maintain a monochromatic format:

- a. A significant amount of current learning research is highly suggestive that color, in and of itself, can serve to be deleterious to the learning process. Throughout, the central view maintained by the authors is to present the minimum of stimulus material held to be necessary for learning to occur.
- b. Since all television receiver/monitors are capable of displaying monochromatic (black and white) displays, while not all sets are capable of color, use of monochrome enlarges the base of users who can utilize these programs.

2. What about graphic displays and symbology?

The graphic displays which have been chosen represent some compromises between displays with an ideal level of clarity, and the inherent capabilities of the computer for graphic display.

Here are some of the discrepancies which resulted from these compromises:

- a. Users will find an intermixture of large display numbers and smaller text generated numbers on the screen. This intermixture represented some compromise between the display capabilities of the computer and the textual requirements of the instructions being provided on the screen. As units progress in complexity, greater reliance will be found in the utilization of the text printed numbers. This occurs both as the student gains increasing familiarity and skill with manipulating the numbers, and as the density of the text accompanying the numeric displays increases.
- b. All text is found to be displayed in upper case letters. This is consonant with the text routines that are ordinarily available in the Apple. Since phrases generated are limited in length and the duration is sufficiently long for the average reader to perceive the information presented, this is not seen as a significant problem in the reading of the information displayed.

3. Trial and Error -vs- Error Cueing

The question of when and how to reinforce (reward) correct or incorrect learner response is likely to get as many divergent answers as is the number of those who respond. The contention of the authors is that the computer's lack of response to some incorrect questions serves, in general, several purposes:

- a. The computer will be, for most students, a new, unfamiliar, and at times anxiety arousing tool for him to use. Overly large doses of commentary by the computer relative to incorrect answers are not seen as helpful towards establishing a comfortable attitude towards this new tool. The computer, by simply not responding until a correct response is entered, seems a far better way at times to

engender positive learning attitudes towards both the computer and the learning software. A more frequent response after some initial prompting which is seen throughout the programs is the computer responding "WRONG TRY AGAIN". This response quickly disappears and the same input question is accepted from the learner.

- b. Some who have used this program have commented that in some cases the student can keep hitting any key, or combination of keys until the correct answer is found, and that in their view only one response should be allowed. Our answer to this is as follows:

We believe that in order for a student to profit from this learning experience, he must be a participant in the management of his own learning; this implies that he must be a willing participant in having a useful dialogue with the computer. No matter how elaborate the scoring schema, the student can circumvent it by guessing, playing, or in other ways capriciously interacting with his terminal. We think the trial and error reloop built in many of the expected student responses serves to both encourage experimentation, while at the same time requires of the student that he take responsibility for his own learning, since no one else will do this for him.

4. Constructed -vs- Selected Response

All problem sets throughout these programs, including the pre-test, are answered by multiple choice response. Since the constructs being taught in Decimals are essentially both new, and at a level of abstraction significantly above the skills required to manipulate whole numbers, it seemed appropriate to narrow the range of work the student must do to achieve a correct answer; in effect, the construction of the selected response tests provide the student with both a starting point, and some "hurdle help" which we think increases his willingness to attempt problem solution.

CLASSROOM UTILIZATION

The following are some applications which may be used by the classroom teacher in administering the decimals programs. The authors recognize that there will be a large number of settings in which the decimals programs may be found and that the number of computers available to students will vary greatly. Each of the following is a separate usage that is applicable in terms of the teacher's own organization of his or her classroom.

The Computer in the Learning Resource Center

In many instances in the elementary school a single computer will be available for instructional purposes. It may be found in a learning resource center or the school library with other audio-visual equipment. In this instance, teachers may wish to either after the start of instruction in some area of decimals, or for remedial purposes, send students on an individual basis to use the decimals programs. This will be particularly true where individual students have experienced some difficulty with some area of decimals. We do not feel that the Pre-Test is a sufficiently powerful diagnostic instrument to serve on its own as a prescriptive tool for precisely specifying what unit in the series a student should start with. Coupled, however, with other materials that the teacher has developed, the Pre-Test can serve to help the student assess his own skills to point to the decimals units he should enter.

If the teacher is desirous of prescribing an appropriate unit, the student should be instructed to select that specific program from the menu. Thus, for example, students could be told to simply take the unit on addition or percentage, as the case might be.

Another instance in which the computer could well administer the entire series would be for younger students who are doing well in their math curriculum and are being prescribed quest or accelerated activities. In this instance, the teacher can simply turn the students loose with the disk and suggest that they proceed through the units at a pace which is comfortable for them.

Use of the Computer Within the Classroom Environment

In some instances, teachers will have available to them the computer within the confines of their own classroom. A single computer thus becomes a powerful adjunct to classroom instruction. There are several ways in which the teacher may choose to use the computer if it is available within the classroom itself.

1. For Group Instruction

With a single computer in the classroom, the teacher may choose to use that computer as a group instructional tool. If the computer is placed in the room such that two or more monitors are connected to it, the teacher can either do the data entry himself or may choose a student to do the data entry, as classroom instruction is delivered to the entire watching class. The questions which appear on the screen can be answered by individual members of the class with the teacher or a student entering the correct response or the response given by students, and thus becoming a group interactive tool for the delivery of instruction.

2. For Individual Remediation

Within the class, some students will obviously need more help than others in dealing with the concepts involved in using decimals. Each of the learning programs may be prescribed by the teacher for individual students having difficulty with specific skills in the use of decimals. Teachers can record how well the student has done by looking at the score following the problem sets at the end of each of the units.

3. For Introductory Instruction

Just as there are students who will be slower and need intensive remediation, there will also be students who are ready to proceed more rapidly than the rest of the class. The classroom computer can thus be used for quest or accelerated activities on the part of the individual student.

SOME PROGRAMMING CONSIDERATIONS

There are many teachers who will be bringing their own personal computers into the classroom, and who have some programming skills. Teachers in this category may wish to make modifications in one or more of the programs. Unlike the earlier Fractions program, the scoring and display algorithms, as well as the ranges of variables introduced do not well lend themselves to substantive modification by the classroom teacher. Teachers wishing to make such modifications, are advised to contact Edu-Ware Services directly before attempting to change any listings. Edu-Ware cannot warranty any program which has undergone changes by unauthorized programmers.

Edu-Ware will endeavor, through consultation to suggest specific changes which users may wish to make and will give consultative assistance when feasible, but is not prepared to make substantive modifications in any programs on a custom basis.

SERVICE REQUEST FORM
EDU-WARE SERVICES, INC.
22222 Sherman Way, Suite 203
Canoga Park, CA 91303
(213) 346-6783

1. PRODUCT: _____ 2. SERIAL #: _____

3. SYSTEM: _____ 4. MEDIA: _____

-----SERVICE-----		AMOUNT-----
WARRANTY SERVICE	(no charge)	proof of purchase date enclosed
DEFECTIVE MEDIA / UPDATE	(\$5.00)	
SHIPPING (\$2.00 unless covered by warranty)		
5. TOTAL	(enclose check or C.O.D. charges will be added)	

6. DESCRIPTION OF PROBLEM (be as complete as possible. Use separate sheets if necessary. If applicable, be sure to specifically describe the operation you were performing when the failure occurred.)

7. PURCHASED FROM: _____ 8. DATE: _____

9. Please use --->>!
this space for your !
address. It will !
be used as a mailing !
label (include zip !
code). !

10. TELEPHONE #: !

() !

PROBLEMS ?

Edu-Ware is firmly committed to supporting the users of its products. This support consists of a 30-day warranty, followed by unlimited low-cost service and updates. Note that the Edu-Ware Warranty applies equally to both "glitches" (bad media problems) and "bugs" (program errors).

Regardless of the nature of your problem, we would ask you to use the form on the back of this page in addressing our Service Dept. In the event that charges are in order, please accompany your service request with a check or money order, otherwise your return shipment will be sent via U.P.S., C.O.D. Please note that in all cases, you must include your original serialized program diskette as proof of purchase. (However, we normally replace it with a fresh diskette.)

IMPORTANT NOTE:

Many program errors are the result of a defective disk drive, and not program "bugs" or "glitches". Whenever you experience software trouble, you should compare the results of the various commercial software packages you may own. If you consistently find trouble, consult your computer dealer.

EDU-WARE 30-DAY WARRANTY

Edu-Ware Services, Inc. warrants this software package to operate within all specifications contained in its accompanying documentation. Should this package fail to meet its specifications within 30 days of purchase by the end user, Edu-Ware Services, Inc. will, at its sole discretion:

1. Correct the failure, by replacement of the defective or error-laden media, upon receipt of the defective program diskette, proof of purchase date, and written description of the problem.

--OR--

2. Refund the original purchase price, upon receipt of the defective program, documentation and accompanying materials.

This warranty is null and void in cases where the user has attempted to make modifications in the program, physically damaged the program diskette, or obtained the product through an unauthorized or illegal distribution channel.

Edu-Ware Services, Inc. will assume no responsibility for the suitability of its products to the user's application. The purchaser must assume all responsibility for the suitability of the application. Edu-Ware Services, Inc. reserves the right to make improvements in its products at any time, and without notice, and to replace any defective products with improved versions.

Incidental and consequential damages caused by the malfunction, defect or otherwise, and with respect to the breach of any expressed or implied warranty are not the responsibility of Edu-Ware Services, Inc., and to the extent permitted by law, are hereby excluded both for property damage, and to the extent not unconscionable, for personal injury damage. Some states do not allow the exclusion of incidental or consequential damages, so the above may not apply to all users.

From Edu-Ware:

COMPU-MATH DECIMALS™

The final program in Edu-Ware's Compu-Math series, Decimals builds and reinforces mathematics skills in the home or classroom. This system features animated graphic displays, periodic goal specification, immediate feedback, and ease of operation which serves to motivate young learners to work unassisted.

Seven major skill areas have been identified and pooled within Learning Units:

- ★ Definition and Decimal/Fraction Conversion
- ★ Addition stresses placement of trailing zeros and carrying columnar values.
- ★ Subtraction emphasizes the basic skill of subtraction, and borrowing techniques.
- ★ Rounding Off develops this skill required for multiplication and division.
- ★ Multiplication places heavy emphasis on correct decimal point placement.
- ★ Division reviews and practices the basic algorithm for long division before turning to decimals.
- ★ Percentage tackles the difficult concepts of determining, multiplying, increasing, and decreasing given percentages.

The system itself assumes that the Learner possesses entry-level arithmetic skills. A Pre-Test gauges the Learner's current skills and routes him into the learning objectives. From then on, the Learner interacts with the computer through a sequence of concepts and exercises which reinforce correct performance. Post-testing verifies that learning has taken place.

Provided within is comprehensive documentation which illustrates all procedures in language designed for the young learner. Another section addresses the teacher, defining the instructional model, suggesting formats for classroom utilization, and delineating possible modifications which will tailor the system to individual classrooms.

Designed for Apple II and II-plus computers.
Requires 48K, Disk Drive, and Applesoft.

Edu-Ware products are strongly supported after sale through a Limited Warranty, rapid service, and low-cost updates and replacements.